on general theory and second on the application of this theory to particular types of apparatus. In the part on general theory we note the author using the crank diagram for vector represention of alternating quantities. This departure from his previous custom (use of the polar diagram) is not due to the conviction that the crank diagram is superior to the polar (in fact the author still thinks the polar diagram preferable) but the crank diagram is used to make the text conform with the recommendations of the Turin International Electrical Congress. This change in Steinmetz's notation will undoubtedly be appreciated by engineering students who, in so far as the writer knows, never were able to see the superiority of the polar diagram and who were always somewhat confused in reconciling the almost universally used crank diagram with Steinmetz's pet, the polar diagram.

The second part of the text on Special Apparatus is opened with a brief analysis of the scheme of classification used in presenting the various machines. While the author's classification may upset some of our present notions, the sense of it is at once apparent and it will surely come into favor in the future. The electrical machines discussed fall into one or the other of five broad classes, each class embracing all machines operating on a given principle, whether motor or generator. These classes are: Synchronous machines, direct current commutating machines, synchronous converters, alternating current transformers and induction machines.

Many readers of electrical literature have all of Steinmetz's books; certainly every one should have at least this elementary text on alternating current circuits and machines.

J. H. M.

Electrical Engineering. By T. C. BAILLIE. Vol. I. Cambridge, University Press: G. P. Putnam's Sons. Pp. 236, 131 illustrations.

This text, dealing in an elementary fashion with electric circuits, machines and measurements, is intended as the introductory volume of a series of electrical texts being published in the Cambridge Technical Series.

On reading the book nothing new is found, either in subject-matter or method of presentation. There are several other books to be had which cover the same ground in practically the same way.

The title of the book is apt to mislead one regarding its contents; it might more suitably be called an introduction to the subject of electrical engineering. The work covered in the text is ordinarily given in a technical school by the department of physics, as will be evident from a brief review of the contents. The chapters are entitled: Currents of Electricity, Magnetism, Current Measurement. Electromotive Force, Resistance Measurement, The Potentiometer, Batteries and Electric Light.

The subject-matter is logically presented and is fairly well illustrated by original diagrams and cuts of commercial apparatus. To the layman desiring a knowledge of some of the underlying principles of electrical engineering or to the student attacking the subject for the first time, the text would be very helpful.

J. H. M.

Electrical Instruments in Theory and Practise. By W. H. F. MURDOCH and W. A. OSCHWALD. The Macmillan Co. 366 pp., 164 illustrations. $2.75 net.

The writers of this excellent book evidently possess the two requisites for a successful text, mastery of the subject and the ability to express their ideas clearly. One is convinced on reading this book on meters that the authors have carefully considered the theory of the various instruments and have worked sufficiently with the meters themselves to grasp the errors which may occur and the ways in which they can best be eliminated. A very useful feature of the book consists of experimental data which is liberally given throughout to show how nearly the theory may be expected to agree with practise.

The first chapter gives a condensed history of the early attempts to measure electrical quantities; it serves well to give the student a proper appreciation of the modern metering devices.

The second chapter deals with damping and how it is obtained in meters. Permanent magnet instruments, iron core instruments, electrostatic meters, hot-wire meters and dynamometer meters each receive one chapter.

Watt-hour meters are discussed at some length; the errors in reading due to friction, short circuits, etc., are illustrated by experimental results. Magnetic testing apparatus is described and typical results given. The last chapter deals with the Wheatstone bridge, the Kelvin double bridge, and the potentiometer, for both continuous and alternating current circuits.

The writer knows of no book on electrical measuring instruments which is its equal in value to the advanced engineering student. A companion volume dealing with oscillographs, ondographs and other special devices is promised by the authors for the near future; it should receive a hearty welcome.

J. H. M.

SPECIAL ARTICLES

A NEW METHOD FOR THE GRAPHICAL SOLUTION OF ALGEBRAIC EQUATIONS

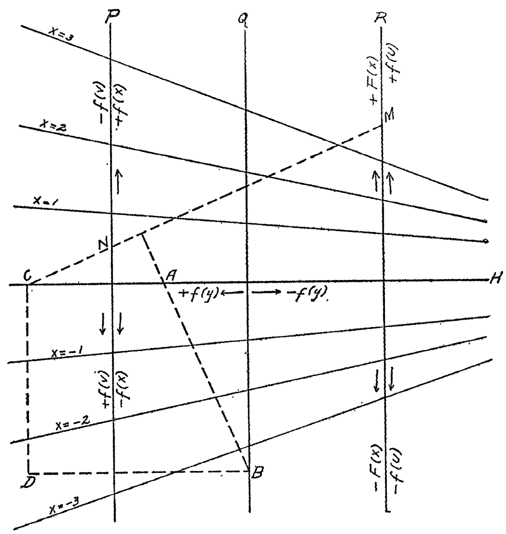
The writer recently devised a graphical method for the solution of algebraic equations that seems to be of such general interest and importance as to be worthy of publication in this journal.

Let us consider first an equation of the type

$$f(u) \cdot f(x) + f(v) \cdot F(x) + f(y) = 0,$$

where $f(u)$, $f(v)$, $f(x)$ and $f(y)$ are the same or different functions of u, v, x and y. Construct a chart (shown in outline in Fig. 1) consisting of three vertical axes, P, Q and R, any convenient distance apart, intersected by a horizontal axis H. Along the right side of the axis P plot the calculated values of $f(x)$, positive values being laid off *upward* and negative values *downward* from the horizontal axis at a rate of A units per centimeter, A being so taken that the values of $f(x)$ likely to be met will fall within the limits of chart.

In a similar way lay off values of $F(x)$ along the left side of the axis R, positive values being measured off *upward* and negative values *downward* from the horizontal axis, at the rate of B units per centimeter, B being so taken that the values of $F(x)$ likely to be met will fall within the limits of the chart.



$f(u)\cdot f(x)+f(v)\cdot F(x)+f(y)=0$

FIG. 1.

Along the horizontal axis lay off values of $f(y)$ at the rate of C units per centimeter, positive values of $f(y)$ being laid off to the *left* of the middle axis Q, and negative values of $f(y)$ to the *right* of that axis; C, being so taken that the values of $f(y)$ likely to be met will not lie too far to the right or to the left of the middle axis Q. Label the points thus located with the values of y used in calculating those of $f(y)$.

Values of $f(v)$ are to be laid off along the axis P in a way similar to that employed in laying off values of $f(x)$, positive values being measured *downward* and negative values *upward* from the horizontal axis H, at the rate of C/mB units per centimeter, where m is the perpendicular distance in centimeters between the outside axes P and R. Label the points thus located with the values of v to which they correspond.

In the same way, calculated values of $f(u)$ are to be laid off along the axis R, positive values being measured *upward*, and negative values *downward*, at the rate of C/mA units